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CENTRAL INTELLIGENCE AGENCY

REPORT

INFORMATION REPORT

CD NO.

50X1-HUM

COUNTRY Germany (Russian Zone)

DATE DISTR. 22 September 1949

SUBJECT Mathematical Research on Circle of Dispersion in Human Eye

NO. OF PAGES 1

PLACE ACQUIRED

NO. OF ENCLS. 2 (LISTED BELOW)

DATE OF INF

SUPPLEMENT TO REPORT NO.

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THIS IS UNEVALUATED INFORMATION

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In 1947, Professor Picht carried out a mathematical investigation of the size of the circle of dispersion (Zerstreuungskreis) in the human eye for a point light-source at infinity for pupil diameters of 1.5, 2.0, 3.0, 4.5, and 5.0 mm.

2. His conclusions may be summarized as follows:

With a point light-source at infinity and for a pupil diameter of 4.5 mm, geometrical optics would place the image (where the circle of dispersion is smallest) at a point 0.4 mm behind the retina and would give the size of the circle of dispersion on the retina itself as 1.2 mm in diameter. The observed focussing of the eye is much better than this, and the discrepancy can be accounted for by applying the theory of wave-optics which shows that, with this diameter of pupil, 80% of the light energy reaching the retina from the source will strike the retina within an ellipse with axes of 0.2 and 0.3 mm length. This is sufficient to give a sharp image.

3. Professor Picht then investigated the distribution of energy along the light axis for the various pupil diameters. He found that for a pupil diameter of 4.5 mm the curve showing the intensity of light energy between the pupil and the point 0.4 mm behind (where the geometrical theory would place the node of the caustic curve) has three maxima and two sharply defined minima. Similar but less sharply defined results were indicated by the theory for pupils of smaller diameters. Results are roughly indicated on the attached sketches.

4. Professor Picht carried out this research at the request of Professor Gurtovoy on behalf of the Russian Academy of Sciences, Potsdam. Picht was told that pure geometrical optics did not explain observed facts in the cases under consideration and he was asked to apply the theory of wave optics to these cases.

5. Professor Picht believes that subsequent experiments, carried out by Professor Gurtovoy in the Babelsberg Optical Institute, were made to see whether the shape of the eye could be altered under conditions of low illumination by noise or by drugs. The final object of the experiments would be to alter the dimensions of the eye so that the retina would lie at a minimum of the energy distribution curve instead of a maximum, and that therefore the subject would be unable to see objects which were poorly illuminated.

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Attachment One

Approximate "Isophote" diagram on retina for pupil diameter of 4.5 mm.

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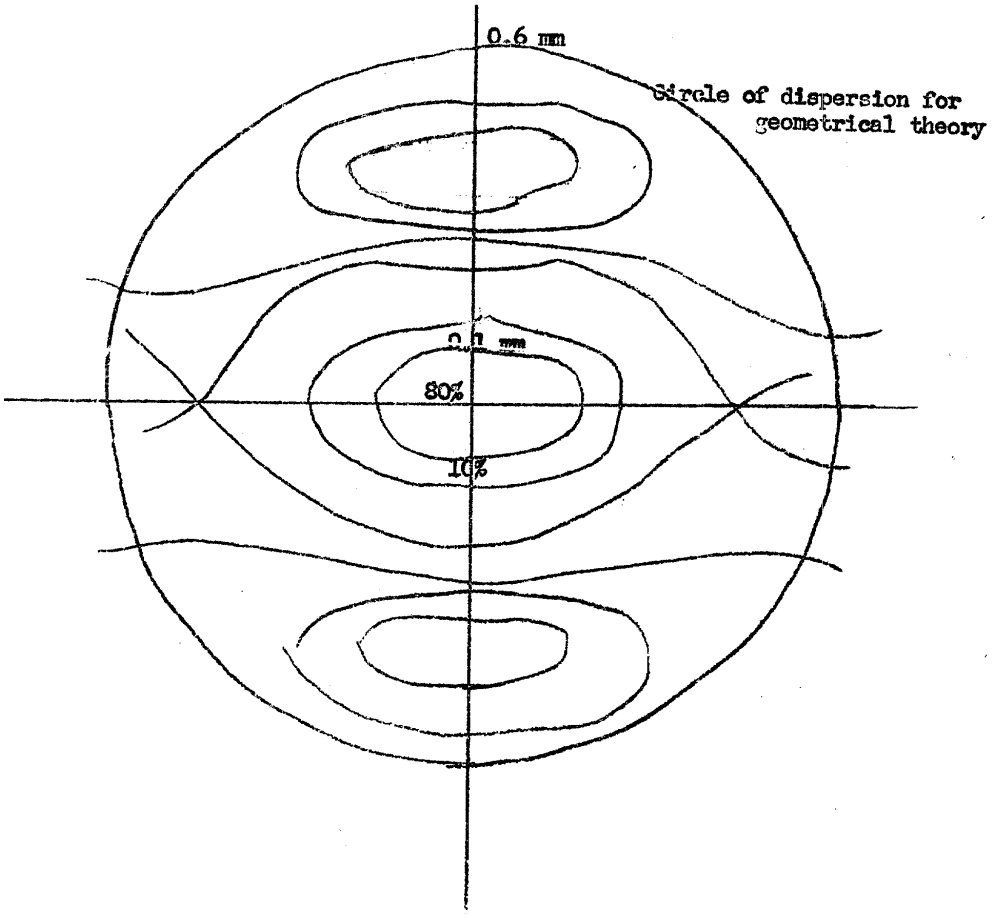

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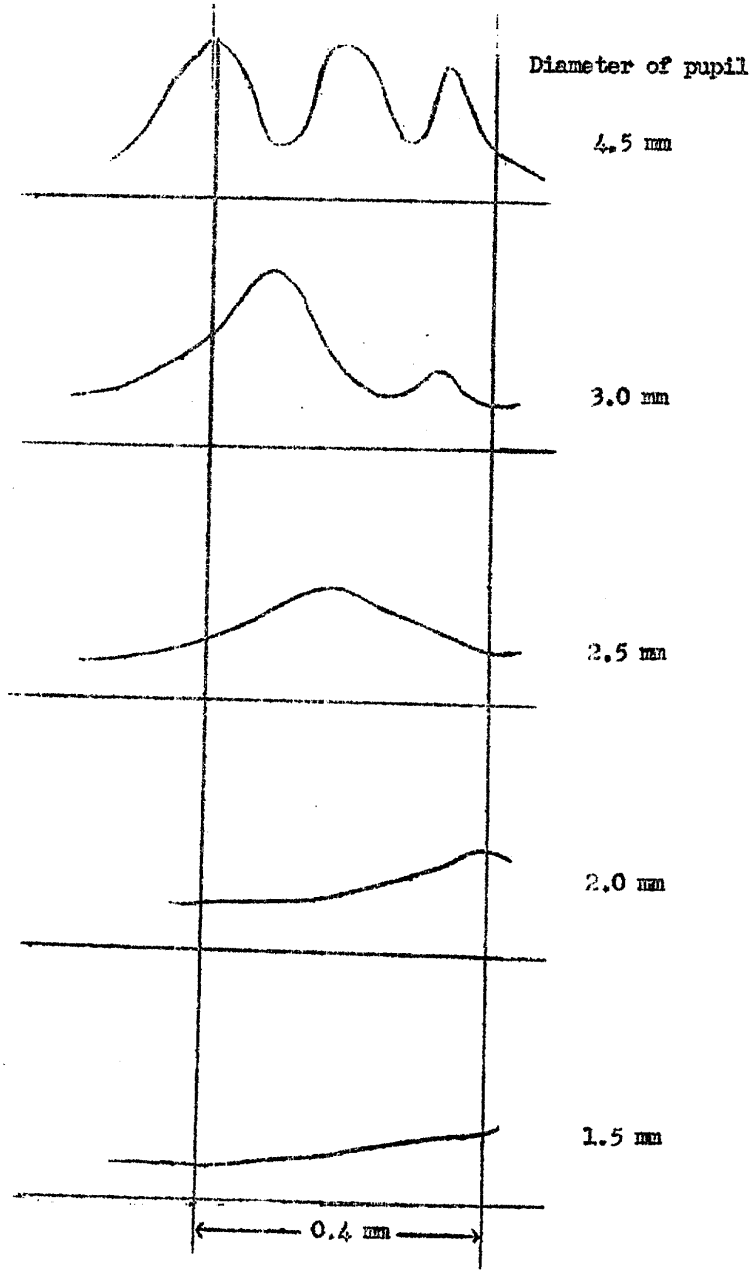
Attachment Two



The above curves are NOT to scale.

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